Stat 252 Winter 2006
Assignment #8

This assignment is due at the beginning of class on Monday, March 20, 2006. You must submit all problems that are marked with an asterix (*).

1. Do the following exercises from Wackerly, et al.

- #9.30, page 433
- #9.34, page 433
- #9.36, page 434
- #9.37, page 434. This problem has a typo in it. It should read: Suppose that $Y_1, \ldots, Y_n$ is a random sample from a probability density function in the (one-parameter) exponential family so that

$$f(y|\theta) = \begin{cases} a(\theta)b(y)e^{-[c(\theta)d(y)]}, & \alpha \le y \le \beta \\ 0, & \text{otherwise} \end{cases}$$

  where α and β are constants and do not depend on θ. Show that $\sum_{i=1}^{n} d(Y_i)$ is sufficient for θ.

2. Do the following exercises from Wackerly, et al.

- #9.74 (a), (c), page 453
- #9.75 (b), page 453
- #9.80, page 454
- #9.81, page 454

3. * A biologist is studying an animal population of unknown size. For each of five consecutive days, she sets a (big) trap in the morning. In the evening, she counts how many animals wandered into her trap, before releasing them. She would like to estimate both p, the probability that any particular animal will be trapped in any particular day, and k, the total size of the population.

(a) Let Y_i denote the number of animals trapped on day i. The biologist postulates that $Y_1, \ldots, Y_n$ are independent and identically distributed as $Bin(k, p)$. Comment very briefly on whether or not you think this is reasonable.

(b) Assume that data $y_1 = 13$, $y_2 = 15$, $y_3 = 14$, $y_4 = 9$, $y_5 = 12$ are observed. Determine the method of moments estimates for k and p.

(c) What if $y_5 = 5$ had been observed, instead of $y_5 = 12$. Recompute your estimates. Do you have any comments?

(*Note: This is an uncommon use of the $Bin(k, p)$ distribution. Experiments where k is known (fixed by the experimenter) and only p is unknown are much more common.*)